CLAIMS

1. A method of driving a composite power amplifier having a first power amplifier entity and a first power amplifier entity pair, in turn including a second and a third power amplifier entity, the first, second and third power amplifier entities being connected to a common signal input over a control network and to a common load output over a combiner network, the method comprising the steps of:

determining a momentary amplitude of an input signal of the signal input and correlating the momentary input signal amplitude to a momentary output voltage amplitude; and

driving the first power amplifier entity with the input signal, **characterised by** the further step of:

restricting the second and third power amplifier entities at momentary output voltage amplitudes below a first output voltage amplitude to deliver less current than a linearly increasing current function defined by zero current at zero momentary output voltage amplitude and a minimum required current at a momentary output voltage amplitude equal to a maximum linear output voltage that can be achieved with the first, second and third amplifier entities when the second and third amplifier entities deliver current with substantially 180 degrees phase difference;

the first output voltage amplitude being larger than zero but less or equal to the maximum linear output voltage that can be achieved with the first, second and third amplifier entities.

2. The method according to claim 1, **characterised in that** the first output voltage amplitude is substantially equal to the maximum linear output voltage.

3. The method according to claim 1 or 2, **characterised in that** the restricting step comprises the step of prohibiting the second and third power amplifier entities from delivering any substantial current at momentary output

voltage amplitudes below a second output voltage amplitude smaller than the first output voltage amplitude.

4. The method according to claim 1, 2 or 3, **characterised in that** the second output voltage amplitude being substantially equal to a maximum linear output voltage amplitude achievable from the first power amplifier entity when driven alone.

5. The method according to any of the claims 1 to 4, **characterised by** the further steps of:

driving the first power amplifier entity at substantially maximum output voltage at momentary output voltage amplitudes above the second output voltage amplitude; and

driving the second and third amplifier entities to deliver current with substantially 180 degrees phase difference at momentary output voltage amplitudes between the second output voltage amplitude and the first output voltage amplitude on the common load output.

6. The method according to claim 5, **characterised in that** the combiner network in turn comprises a first, a second and a third impedance conversion circuit, respectively, whereby the second and the third impedance conversion circuit have compensation elements having substantially the same absolute value but of opposite sign.

7. The method according to claim 5 or 6, **characterised by** the further step of:

driving the second and third amplifier entities in an outphasing mode at momentary output voltage amplitudes above the first output voltage amplitude.

8. The method according to any of the claims 1 to 7, **characterised in that** the composite power amplifier has at least one further power amplifier entity pair, whereby the method comprises the steps of taking each one of the

at least one power amplifier entity pair in use at respective third output voltage amplitudes and driving the at least one further power amplifier entity pair so that they deliver no current below the respective third output voltage amplitude.

9. The method according to claim 8, **characterised by** the further step of driving the at least one further power amplifier entity pair to deliver current with substantially 180 degrees phase difference at momentary output voltage amplitudes between the respective third output voltage amplitude and a respective fourth output voltage amplitude on the common load output.

10. The method according to claim 9, **characterised by** the further step of driving the at least one further power amplifier entity pair in an outphasing mode at momentary output voltage amplitudes above the respective fourth output voltage amplitude.

11. The method according to any of the claims 1 to 8, **characterised in that** the first power amplifier entity in turn comprises power amplifiers in a Doherty arrangement, whereby the step of driving the first power amplifier entity at momentary output voltage amplitudes below the second output voltage amplitude, in turn comprises driving the Doherty arrangement with the input signal of the signal input.

12. Composite power amplifier, comprising:

a first power amplifier entity;

a first power amplifier entity pair, in turn including a second and a third power amplifier entity;

a common signal input;

a control network connecting the common signal input and the first, second and third power amplifier entities;

a common load output; and

a combiner network, connecting the first, second and third power amplifier entity, respectively, to the common load output over at least one impedance conversion circuit;

said control network in turn comprising means for determining a momentary amplitude of an input signal of the common signal input and relating the momentary input signal amplitude to a momentary output voltage amplitude,

characterised in that the control network is further arranged for restricting the second and third power amplifier entities at momentary output voltage amplitudes below a first output voltage amplitude to deliver less current than a linearly increasing current function defined by zero current at zero momentary output voltage amplitude and a minimum required current at a momentary output voltage amplitude equal to a maximum linear output voltage that can be achieved with the first, second and third amplifier entities when the second and third amplifier entities deliver current with substantially 180 degrees phase difference;

the first output voltage amplitude being larger than zero but less or equal to the maximum linear output voltage that can be achieved with the first, second and third amplifier entities.

13. The composite power amplifier according to claim 12, **characterised in that** the first output voltage amplitude is substantially equal to the maximum linear output voltage.

14. The composite power amplifier according to claim 12 or 13, **characterised in that** the control network is arranged for prohibiting the second and third power amplifier entities from delivering any substantial current at momentary output voltage amplitudes below a second output voltage amplitude on the common load output smaller than the first output voltage amplitude.

15. The composite power amplifier according to claim 12, 13 or 14, **characterised in that** the second output voltage amplitude being

substantially equal to a maximum linear output voltage amplitude achievable from the first power amplifier entity when driven alone.

16. The composite power amplifier according to any of the claims 12 to 15, **characterised in that** said first power amplifier entity has a maximum output power $P_0^{\max}$ selected according to:

$$P_0^{\max} < P_{tot}^{\max} \cdot \frac{V_P}{V_{tot}^{\max}},$$

where $P_{tot}^{\max}$ is a total maximum output power of all power amplifier entities, $V_{tot}^{\max}$ is a maximum output voltage amplitude and V_P is an output voltage amplitude corresponding to an intended efficiency maximum.

17. The composite power amplifier according to any of the claims 12 to 16, **characterised in that** the control network is further arranged for driving the first power amplifier entity at substantially maximum output voltage at momentary output voltage amplitudes above the second output voltage amplitude and for driving the second and third amplifier entities to deliver current with substantially 180 degrees phase difference at momentary output voltage amplitudes between the second output voltage amplitude and the first output voltage amplitude on the common load output.

18. The composite power amplifier according to claim 17, **characterised in that** said combiner network in turn comprises a first, a second and a third impedance conversion circuit.

19. The composite power amplifier according to claim 18, **characterised in that** the second and the third impedance conversion circuits comprise compensation elements of substantially the same absolute value but of opposite sign.

20. The composite power amplifier according to claim 19, **characterised in that** the compensation elements of the second and third impedance

conversion circuits are selected to place the second efficiency maximum slightly above the expected value of the output voltage amplitude.

21. The composite power amplifier according to any of the claims 17 to 20, **characterised in that** the control network is further arranged for driving the second and third amplifier entities in an outphasing mode at intended momentary output voltage amplitude responses above the first output voltage amplitude.

22. The composite power amplifier according to any of the claims 12 to 21, **characterised by** at least one further power amplifier entity pair.

23. The composite power amplifier according to any of the claims 12 to 22, **characterised in that** the first power amplifier entity in turn comprises power amplifiers in a Doherty arrangement.
